

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No. : 09/825,473  
Applicant : Michael V. Glazov et al.  
Filed : April 3, 2001  
Title : **"Thermally Stable Alumina Particulates"**  
Group Art Unit : 1754  
Examiner : Cam N. Nguyen

MAIL STOP NON-FEE AMENDMENT  
Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

**RESPONSE**

Sir:

In response to the Office Action dated August 13, 2003, Applicants submit the following remarks.

**Remarks begin on Page 2 of this paper.**

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Theresa Ulinski

(Typed Name of Person Depositing Mail)

Signature

11/13/2003  
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1754

Application No. 09/825,473  
Amendment Dated November 13, 2003  
In Reply to USPTO Office Action dated August 13, 2003  
Confirmation No. 2114  
Attorney Docket No. 4430-010259  
Alcoa Docket No. 99-2051

**REMARKS**

Claims 1-13 are rejected under 35 U.S.C. § 112, first paragraph, for asserted failure of the specification to define the phrase “inorganic hydroxyl group anion-exchanger” and under 35 U.S.C. § 112, second paragraph, for asserted indefiniteness of that phrase.

Claims 1-13 are rejected under 35 U.S.C. § 103(a) for obviousness over U.S. Patent No. 5,155,085 to Hamano et al. taken together with U.S. Patent No. 3,853,789 to Warthen et al. and in combination with U.S. Patent No. 5,573,582 to Inui et al.

Applicants respectfully traverse these rejections for the following reasons.

**35 U.S.C. § 112, first and second paragraphs**

The phrase “inorganic hydroxyl group anion-exchanger” is used in its conventional sense throughout the specification. One skilled in the art would understand it to mean a material for effecting a reversible interchange of one kind of ion present on an insoluble solid with another of like charge present in a solution surrounding the solid. This is particularly evidenced by Example 1 which describes treatment of a solution of  $\text{Al}(\text{NO}_3)_3$  with a commercially available anion-exchanger which is well known to be a resin-based ion exchange product. One skilled in the art would understand that the “inorganic hydroxyl group anion-exchanger” used to accomplish the anion exchange reaction shown in paragraph 15 of the specification cannot merely be an alkaline reagent, but must refer to a solid ion exchange product that is used to treat the salt solution. Example 1 identifies one suitable inorganic hydroxyl group anion-exchanger. The selection of such a material for anion exchange is within the ability of a skilled artisan. As such, the specification sufficiently enables one skilled in the art to practice the invention, and the claims are

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sufficiently definite to indicate what is encompassed by the invention. Withdrawal of the rejections under 35 U.S.C. § 112, first and second paragraphs, is respectfully requested.

35 U.S.C. § 103(a)

The August 13, 2003 Office Action did not directly address the points set forth in the Appeal Brief submitted May 28, 2003. Hence, those points are set forth again below.

The present invention is directed to a method of preparing lanthanum-stabilized transitional alumina (e.g. La-stabilized  $\gamma$ -alumina) with high thermal stability by treating a solution of aluminum (with addition of a lanthanide series element such as La) with an anion-exchanger to produce hydroxides of aluminum and the lanthanide series element, such as  $\text{Al}(\text{OH})_3$  and  $\text{La}(\text{OH})_3$ . The resulting composition is freeze-dried, yielding a powder that is subsequently dehydrated to produce particulates of La-stabilized  $\gamma$ -alumina. Claim 1 requires the use of lanthanum, and claim 6 requires the use of a lanthanide series element. The freeze-drying step is particularly important for maintaining the specific surface area of the aluminum in contrast to thermal drying techniques, which are detrimental to the alumina. While techniques relating to use of anion-exchangers and freeze-drying have been described in the prior art, their combined use as in the present invention has not been taught or suggested. The combination of these features of the claimed invention yield complete stabilization of  $\gamma$ -alumina (as evidenced by standard industry test of 3 hours hold at 1200° C) at very low concentrations of La (0.1 to 0.3 molar % per claim 11). Lanthanum is a very costly component; hence, opportunities to reduce the level of its use are desirable.

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Claims 1-10, 12 and 13 define over the cited references for the following reasons. Hamano discloses a process for producing transition alumina (primarily  $\gamma$ -alumina) according to the following steps:

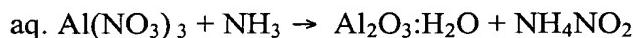
- (1) producing an aqueous solution of a mixture of aluminum sulfate and a lanthanum compound;
- (2) heating the mixture to drive off the water by one of an oven, oilbath, dry spray, flow drying, kneader, vacuum drying, ribbon dryer and paddle dryer; and
- (3) thermally decomposing the dried mixture at 800-1500° C for 0.1 second to 100 hours.

As noted in the August 13, 2003 Office Action, Hamano fails to teach at least steps (b) and (c) of claims 1 and 6. In both claims, step (b) requires treatment of a solution of an aluminum salt and a lanthanum compound with an inorganic hydroxyl group anion-exchanger to produce a hydroxide composition (aluminum hydroxide with a lanthanum hydroxide). Both claims also require in step (c) that the hydroxide composition is freeze-dried.

Warthen is relied upon to account for the deficient teachings in Hamano of the claimed step (b). The August 13, 2003 Office Action states that it would have been obvious to treat the solution of step (1) of Hamano with an alkaline reagent to produce a precipitate of aluminum hydroxide and lanthanum hydroxide at pH 6-11 because Warthen supposedly teaches to do so to obtain alumina with high mechanical strength and attrition resistance in the passage at column 2, lines 18-36. That portion of Warthen instructs precipitation of a hydrous alumina gel by one of two processes: alkali metal aluminate salt solution added to an acid or an alkaline reagent added to an acid aluminum salt solution. The August 13, 2003 Office Action equates the latter process of precipitating a hydrous alumina gel from an acid

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aluminum salt solution and alkaline reagent with the claimed step (b) of treating the aluminum/lanthanum solution with a hydroxyl group anion exchanger. However, Warthen actually describes a different process by stating that the latter precipitation process may involve an acid aluminum salt solution (aluminum nitrate, aluminum chloride or aluminum sulfate) treated with ammonia. An example of such a process is as follows:



That process does not involve treatment of a salt solution with hydroxyl group anion exchanger. Moreover, there is no description of an intermediate hydroxide product (an aluminum hydroxide) as required in the claimed invention. In the absence of some teaching to even produce a hydroxide, there can be no motivation to use a hydroxide anion-exchanger. Hence, Warthen fails to suggest to one skilled in the art to modify the Hamano process by treating an aluminum/lanthanum solution with hydroxyl group anion exchanger.

Inui is relied upon to account for the deficient teachings in Hamano of the claimed step (c) of freeze drying the hydroxide solution. Inui describes thermal drying of aluminum hydroxide. At column 7, lines 20-49, Inui states:

Said hydroxide slurry prepared by the process of the present invention can be separated into solid and liquid by the treatment such as evaporation, drying and filtration.

As the solid-liquid separation, the method using a pneumatic conveying dryer (in this specification it is referred to as "said pneumatic conveying drying method") and the method comprising heating said hydroxide slurry to or above the boiling temperature of the liquid at atmospheric pressure and spraying said heated hydroxide slurry with pressure from a nozzle using flash dryer (in this specification, it is referred to as "said flash drying method") are preferred as a particularly suitable embodiment, since said hydroxide can be effectively isolated without agglomeration.

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Dryers are generally classified into 8 kinds, as shown below, based on their mechanism:

1. material standing-type dryer,
2. material transferring-type dryer,
3. material stirring-type dryer,
4. hot-air transferring-type dryer,
5. cylindrical dryer,
6. infrared rays dryer,
7. freeze dryer, and
8. high-frequency dryer,

(reference: "Kagaku Kogaku Binran" Fifth Edition, p. 683, Published by Maruzen).

The pneumatic conveying dryer is included in the hot-air transferring-type dryer and the flash dryer does not fall under the conventional classification and utilizes flash evaporation.

That passage lists freeze-drying as one of eight classes of drying techniques, but Inui only considers pneumatic conveying drying (characterized therein as a type of hot-air transferring drying) and flash drying as two suitable techniques of the eight potential choices. There is no motivation provided for substituting some other drying technique (i.e., freeze-drying) for the only two techniques described as useful in solid-liquid separation of an aluminum hydroxide slurry. The August 13, 2003 Office Action argues that Inui discloses freeze-drying as a suitable technique "for performing a similar process". However, Inui only states that freeze-drying is one of eight drying techniques – NOT that it is an option for drying an aluminum hydroxide slurry. Inui does not state that freeze-drying is a viable alternative to the two techniques specifically disclosed. A simple list of known drying techniques (with two being singled out as suitable for drying aluminum hydroxide slurry) does not rise to the level of actually suggesting that one of those techniques not singled out should be used as in the claimed invention.

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For the foregoing reasons, the subject matter of claims 1-10, 12 and 13 is nonobvious over the combined teachings of Hamano, Warthen and Inui.

Claim 11 ultimately depends from claim 6 and requires that the concentration of lanthanum oxide in the  $\gamma$ -alumina is about 0.1 to about 0.3 mol %. Claim 11 defines over the cited references for the same reasons as claims 1-10, 12 and 13. In addition, the August 13, 2003 Office Action asserts that it would be obvious to optimize the lanthanum concentration in order to obtain a more effective alumina material.

However, optimizing at such a low level of lanthanum is actually taught away from by Hamano. Hamano states that low levels of La (e.g., 0.3 mol % or less) are problematic at column 4, lines 54-58:

If an amount of lanthanum to be added is lower than 1 part by weight based on 100 parts by weight alumina [which corresponds to about 0.3 molar % La], an insufficient effect to inhibit a reduction in the specific surface area owing to the use at high temperatures will be obtained.

Hamano directly contradicts the assertion that low level optimization would be obvious since Hamano teaches that low levels of La would be detrimental to the alumina, namely by reducing the specific surface area of the alumina.

The cited references do not in combination provide motivation to use a hydroxyl anion-exchanger in producing an intermediate aluminum hydroxide, in conjunction with subsequent freeze-drying of the La-doped aluminum hydroxide. The features of claimed steps (b) and (c) uniquely provide for the opportunity to use extremely low concentrations of La (0.1-0.3 mol %) to achieve complete thermal stabilization of  $\gamma$ -alumina, as evidenced by the x-ray diffraction patterns of  $\gamma$ -alumina completely stabilized with 0.1 and 0.3 mol % La in Figs. 3 and 4 of the present application and to make the stabilized alumina

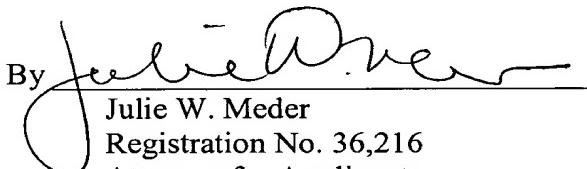
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product very inexpensively as compared to the prior art. Hence, claim 11 is believed to further define over the prior art of record.

For the foregoing reasons, claims 1-13 are believed to define over the prior art of record and be in condition for allowance.

Respectfully submitted,

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Serial No.: 09/825,473 Filing Date: April 3, 2001  
Examiner: Michael V. Glazov et al. Group Art Unit: 1754  
Invention: "Thermally Stable Alumina Particulates"

Transmitted herewith is an Amendment in the above-identified application.

- Small Entity Status is/has been asserted for this application under 37 CFR 1.27.  
 A verified statement to establish small entity status under 37 CFR 1.27 is enclosed.  
 No additional fee is required.  
 The fee has been calculated as shown below:

No.of Claims After Amendment	Highest No. Previously Paid For	Present Extra	Small Entity Rate	Non-Small Entity Rate	Charge
Total <u>13</u>	<u>20</u>	<u>0</u>	x \$ <u>9.00</u>	x \$ <u>18.00</u>	\$ <u>00.00</u>
Indep. <u>2</u>	<u>3</u>	<u>0</u>	x \$ <u>42.00</u>	x \$ <u>84.00</u>	\$ <u>00.00</u>
First Presentation of Multiple Dependent Claim/s					
TOTAL ADDITIONAL FEE					
\$ <u>00.00</u>					

- Check in the amounts of \$    is enclosed to cover the excess claim fee.  
 Check in the amount of \$    is enclosed for a    month Petition for Extension of Time.  
 The Commissioner is hereby authorized to charge payment of the following fees associated with this communication to Deposit Account No. 23-0650. Please refund any overpayment to Deposit Account No. 23-0650. An original and two copies of this sheet are enclosed.  
 Any additional filing fees required under 37 CFR 1.16.  
 Any patent application processing fees under 37 CFR 1.17.

November 13, 2003

Date

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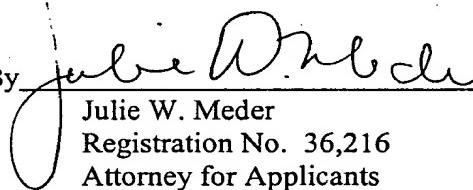
No. of Claims	Highest No.	Small	Non-Small
After	Previously	Entity	Entity
Amendment	Paid For	Present	Rate
Total <u>13</u>	<u>20</u>	<u>0</u>	x \$ <u>9.00</u>
Indep. <u>2</u>	<u>3</u>	<u>0</u>	x \$ <u>42.00</u>
First Presentation of Multiple Dependent Claim/s		+ \$140.00	+ \$280.00
TOTAL ADDITIONAL FEE			\$ <u>00.00</u>

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